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ABSTRACT

This thematic magazine helps teachers explore archaeology through an introductory article and three lesson plans, one with a student-take-home worksheet. Lesson 1 is designed for group work and involves identification of "artifacts" taken from familiar, contemporary settings, as the students attempt to describe the function of each artifact and to interpret possible associations between artifacts. Lesson 2 uses a whole class demonstration followed by independent seat work as students identify methods archaeologists use to relatively date soil layers and interpret soil profiles. Lesson 3 includes a take-home worksheet (two copies: one in English, one in Spanish) that helps students understand how archaeologists use typology to interpret artifacts as they interpret sample artifacts. The Resource page includes Internet addresses for on-line research. (DQE)

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ART to ZOO

TEACHING WITH THE POWER OF OBJECTS

Smithsonian Institutions November/December 1995

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DECODING THE PAST: The Work of Archaeologists

Inside	Subjects	Grades
Lesson Plan	Social Studies	4–9
Take-Home Page in English/Spanish	Science	
	Language Arts	

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Above photo: *The layering of the veil cloth is also about the past. Boy Bwa Kevin*

Cover photo: *Smithsonian Institution*
break during the River Basin Sur

Art to Zoo's purpose is to help teachers bring into their classrooms the educational power of museums and other community resources.

Art to Zoo draws on the Smithsonian's hundreds of exhibitions and programs—from art, history, and science to aviation and folklife—to create classroom-ready materials for grades four through nine.

Each of the four annual issues explores a single topic through an interdisciplinary, multicultural approach.

The Smithsonian invites teachers to duplicate *Art to Zoo* materials for educational use.

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DECODING THE PAST: The Work of Archaeologists

Whether you're ten or one hundred years old, you have a sense of the past—the human perception of the passage of time, as recent as an hour ago or as far back as a decade ago. We are all explorers of this past, seeking the meaning of today from what happened yesterday. The past stretches far beyond our own experiences; it takes its shape from those who have come before us. The collective memories of our parents and grandparents provide us with an image of more than two generations of human triumphs and tragedies. In fact, the lens of history allows us to view more than thirty centuries of human experience chronicled by a multitude of men and women.

As valuable as they are, however, written accounts cannot present a complete record of human history. Documents speak only of literate societies and are often incomplete. These records are blind to the thousands of years of human experience before the invention of writing. To recover this vibrant human past without written history or memory, we must turn to archaeology—the study of material remains to learn about past human experiences.

Archaeology and its potential to increase our understanding of the distant and the recent human past have long been cornerstones of the research done at the Smithsonian Institution and are the subject of this issue of *Art to Zoo*. The photographs of Smithsonian archaeologists and activities that follow encourage your students to think about how human-made objects and other indicators of human life can enrich our understanding of peoples both past and present. You can use the lesson plans as part of either a world cultures curriculum or any social studies unit that explores methods of understanding the past.

THE PUZZLE OF THE PAST

The human past is like a vast, uncompleted jigsaw puzzle with many scattered pieces. To a historian, the pieces of this puzzle are letters, journals, books, and maps—in short, the whole host of written documents that have survived over time. Documents might be as rare as an original copy of the Declaration of Independence or as common as the daily newspaper.

An archaeologist searches for different pieces of this same puzzle. However, rather than seek what has been written, he or she looks for what has been left behind—in the form of *artifacts* (human-made objects) and other evidence of past human activity.

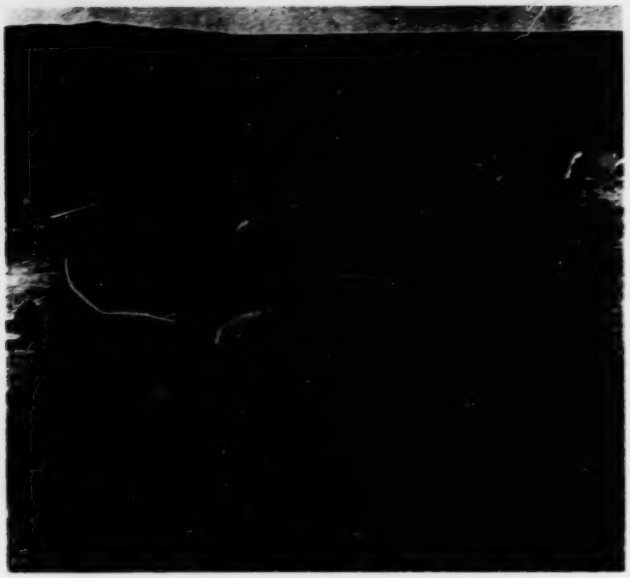
Finding written records of history is different from discovering archaeological puzzle pieces. A historian might know where to look for a potentially important document—perhaps in an archive or a collection of personal papers. In comparison, an archaeologist usually has fewer leads but just as many ways of learning about the past.

SITE SEEING

The first challenge faced by archaeologists is locating a site that will yield clues about the people who once lived there. To that end, several nondestructive methods can help determine whether a certain area may contain artifacts. If a site was once the home of a literate society, an archaeologist can often consult written records for possible clues. When documents are not available, the archaeologist can survey the area through careful observation of surface features and exposed artifacts. If the researcher discovers enough evidence, he or she can employ an arsenal of high-tech tools to explore a site further.

One frequently used tool is aerial photography. Views from the sky offer unique perspectives on an archaeological site, often revealing features that might be less apparent from the ground. By carefully examining patterns of shadows, soil colors, and crop growth, an archaeologist may detect the remains of sunken features such as walls, ditches, and earthworks.

At ground level, a variety of remote sensing techniques can be used to investigate a site without disturbing it. Depending on a soil's composition, an archaeologist might use ground-penetrating radar, soil-resistivity testing (measuring a soil's electrical resistance), or magnetic



An open-area excavation at Big Bend Reservoir, South Dakota

Simplified stratigraphy displaying the chronological progression of soil layers

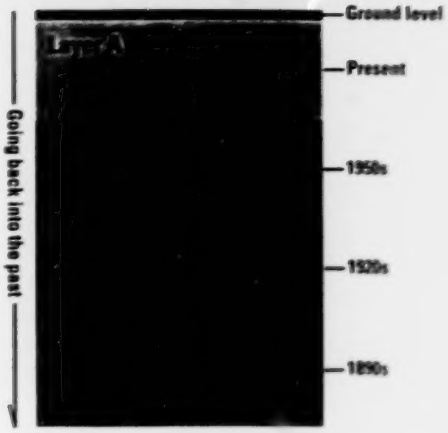


Figure 1

surveys to determine the nature of the materials that lie below the surface. Ultimately, however, carefully directed digging in a site can reveal much more than all the nondestructive methods combined.

DIGGING IN THE DIRT

To an archaeologist, the soil resembles a historical document; the researcher must decipher, translate, and interpret the soil before it can help him or her understand the human past. But unlike a document, the soil of an archaeological site can be interpreted only once in the state in which it is found. The very process of excavation destroys a site forever, making such an investigation a costly experiment that cannot be repeated.

Accordingly, archaeologists conduct excavations with great care. Before an excavation begins, they survey the site meticulously and map it on a grid within a coordinate system. Researchers then reference the locations of all unearthed artifacts or features to their coordinates within the wider site. Archaeologists note unexcavated areas just as carefully, because they may be of interest to other archaeologists in the future.

Many of the tools used in excavation are surprisingly familiar. Archaeologists employ common household utensils such as ladles, spoons, dustpans, and brushes to move small amounts of earth. They use flat-edged shovels to remove larger volumes of soil and root cutters and small hand saws to extract grounded tree roots. However, no single tool is more synonymous with archaeology than the small mason's *trowel*. The sturdy, welded body and tough, steel blade of this tool make it ideally suited for gingerly removing successive layers of soil.

As an excavation progresses, it uncovers the past in both horizontal and vertical dimensions. The horizontal dimension reveals a site as it was at a fixed point in time. The vertical dimension shows the sequence of changes within a site over time. Excavation methods vary according to which dimension of the past an archaeologist chooses to study. A researcher seeking a detailed "snapshot" of a particular point in time would likely initiate a large, open-area excavation. This technique requires archaeologists to uncover a site layer by layer until reaching the level of the desired time period. Alternately, an archaeologist seeking to understand the progression of time at a site would probably employ a grid excavation. Under this method, workers dig evenly spaced square holes, leaving *baulks* (wall-like unexcavated areas) between the squares. Baulks allow archaeologists to examine a site's general stratigraphy and are later removed to reveal whatever might lie within them.

Researchers use more intrusive excavation methods when a site will be obstructed or destroyed by some form of modern development, such as a shopping center. These "salvage" projects force archaeologists to race against time to find evidence. To this end, they conduct "reconnaissance" surveys (small-scale excavations) at random locations, along a predetermined site grid, or wherever they suspect they may find archaeological evidence.

Researchers gather two very different sets of information during the course of any excavation. They can examine tangible findings, such as artifacts and the remains of plants, animals, and humans, well after an excavation has ended. However, excavation

An example of terminus post quem. *The 1885 coin in Layer E establishes that Layer E dates from on or after 1885. It follows that the pottery fragment in Layer D and the bottle cap in Layer B likely date from or after 1885 as well.*

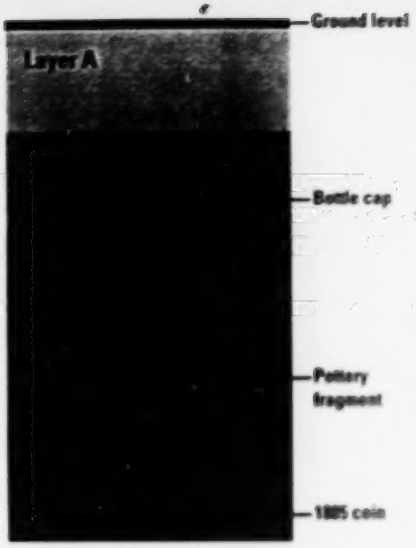


Figure 2

An example of terminus ante quem. *Layer C is an undisrupted tile floor of the 1860s. It follows that Layers D, E, and F date before the 1860s.*

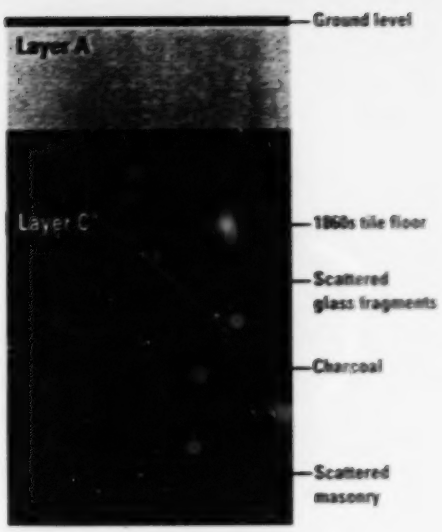


Figure 3

destroys contextual features, such as building remains, as they are uncovered. To preserve vital information about these remains, archaeologists painstakingly catalog every nuance of a site through volumes of photographs and drawings.

INTERPRETING THE EVIDENCE

During and after an excavation, an archaeologist confronts a bewildering collection of artifacts, drawings, and photographs to decipher and relate to one another. Using both relative and absolute dating methods, an archaeologist can often place a site within a larger chronological framework.

In relative dating, archaeologists interpret artifacts based on their positions within the *stratigraphy* (horizontal layering) of the soil. The study of stratigraphy follows the excavation axiom "last in, first out"— meaning that an archaeologist usually removes soil layers in the reverse order in which they were laid down (see Figure 1). In relative soil dating, archaeologists follow two general principles known as *terminus post quem* and *terminus ante quem*. *Terminus post quem* refers to the notion that a datable object provides only the date on or after which the layer of soil that contains it was deposited (see Figure 2). In contrast, *terminus ante quem* refers to the concept that all the soil below a solid, undisturbed layer dates before that layer (see Figure 3).

Relative dating of a site's stratigraphy often depends on the absolute dating of excavated materials and artifacts. One of the most widely used methods of determining the absolute date of organic materials is radiocarbon (carbon 14) dating. Because all living organisms contain a radioactive form of carbon (carbon 14) that decays at a known and steady rate, archaeologists can determine an organic object's age (if it is less than 40,000 years old) by measuring the amount of carbon 14 remaining in the object.

Dating inorganic materials is also quite challenging, because relatively few artifacts come labeled with a date of manufacture. In fact, pottery, the most common type of artifact found at archaeological sites, seldom contains obvious indications of its age. Archaeologists sometimes use thermoluminescence dating to establish the age of pottery. This technique is similar to carbon 14 dating in that, like organic substances, pottery contains small amounts of radioactive elements that decay at known and steady rates. An archaeologist can determine the age of a pottery fragment by measuring the remaining amount of radioactive elements that it contains. Another way of dating pottery and other inorganic materials is through *typology*—comparing undated samples with those from associated sites that have been dated through previous excavations.

DECODING THE PAST

After an archaeologist has gathered, catalogued, and interpreted all of the evidence, he or she begins the most important reporting task of all: putting a human face on the past. A final archaeological report often reflects years of cooperative work among experts from disciplines as diverse as history, medicine, anthropology, chemistry, geology, and biology.

Through the tireless work of these experts, the distant past again resonates with the sound of human voices. Across the millennia, the fragments of human experience remind us that those who have come before were every bit as human as we are.

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LESSON PLAN
Step 1

ARCHAEOLOGICAL THINKING

Objectives

- Identify "artifacts" from a contemporary setting.
- Describe the function of each artifact.
- Interpret possible associations between artifacts.

Materials

- Four or five small paper or plastic bags.
- Artifacts (nontoxic refuse from the school building).
- Copies of Worksheet 1, page 7.
- Pens or pencils.

Subjects

Social studies, science, language arts

Procedure

1. Choose four or five areas in your school with which students are familiar (e.g., your classroom, the cafeteria, and the library). Observe each location, noting what students commonly do there (e.g., study, eat, and socialize). After school hours or when the areas are clear of students, examine the trash and recycle bins and the floors for evidence of those student activities. Select artifacts (e.g., portions of candy wrappers, plastic from pen caps, and portions of student papers) that can help to tell the story of each site. Place each site's artifacts in a separately numbered bag (numbered 1 through 4 or 5).

2. At the beginning of the next class, discuss the difference between historians and archaeologists by asking your students how we know that an event happened in the past. Answers may vary, but students will probably conclude that information about the past event was recorded in some form. You may wish to have your students suggest various methods of documenting past events (e.g., oral histories, written records, video and audio recordings, and digital data) and have them evaluate how each method differs from the others. Tell your students that historians use all of these recorded sources to understand the past. *(Be sure to note that not all societies have kept records and that records can often be incomplete or biased.)* Next, ask your students how they might learn about a past event if they could not read about it or view it on videotape. Some students may find this question difficult. Ask them to think about the work of an archaeologist—what does this type of researcher look for? Students should conclude that an archaeologist seeks physical evidence (clues) of the past.

Artifacts are uncovered by the careful removal of surrounding soil with brushes and trowels. (Medicine Creek Reservoir, Nebraska)

3. Using the Introduction as a guide, tell your students that they will be learning how archaeologists use physical evidence in the form of artifacts (human-made objects) to learn about the past. Tell them to imagine that an archaeological expedition at your school has recently uncovered a number of artifacts that the class must now examine and interpret. Stress that the students were picked for this job because they were the foremost experts on the archaeological sites.

4. Divide your class into four or five groups of equal size. Give each student a copy of Worksheet 1 and provide each group with one of the numbered bags of artifacts. Direct your students to open the bags and carefully examine each object. Ask them to consider what each object is made of and how it may have been used. *(Tell students to put this information on their worksheets.)* Students may find some objects easier to identify than others. Walk among the groups and provide hints as necessary. After the students have identified the objects, ask them to speculate where these objects may have been found. (Tell students to put this information on their worksheets.)

5. Conclude the activity by having a representative from each group explain its interpretation of the objects. Provide explanations of the objects and their contexts as necessary. Emphasize that archaeologists are often challenged with interpreting artifacts that they cannot immediately identify or date.

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WORKSHEET 1
Archaeological Thinking

Group number

Artifact bag number

Directions: Use this worksheet to record your observations of the artifacts provided by your teacher.

Object	Material it is made of	What it was used for (function)

LESSON PLAN
Step 2

LAYERS OF THE PAST

Objectives

- Identify methods archaeologists use to relatively date soil layers.
- Interpret soil profiles.

Materials

- Copies of Worksheet 2, page 9.
- Five textbooks.
- One notebook.
- Paper labels.
- Adhesive tape.
- Pens, pencils, and markers.
- One coin.

Subjects

Social studies, science, language arts

Procedure

1. Using the Introduction as a guide, tell your students that archaeologists often study the soil of a site to learn about the past. Ask your students if they have ever dug into the soil (e.g., when putting in a garden or digging a fence post). What did they notice about the color and texture of the soil? Answers may vary, but students will probably conclude that the color and texture of soil change with depth. Emphasize that soil forms from the gradual decay of organic matter over time. A given soil's layering is determined by the nature of the decaying organic matter (e.g., leaves and logs); weather conditions; and the action of humans, animals, and insects.

2. Explain to your students that they will be learning some of the basic rules archaeologists use to interpret the soil of a site. Ask a student volunteer to place a textbook on your desk (or any other flat surface visible to the entire class). Have the volunteer write the current time on a slip of paper large enough to be seen by the class. Instruct the volunteer to attach the paper to the textbook using adhesive tape. *(If you are using books whose covers damage easily, you may wish to have the volunteer place the paper between two pages of the book, sticking out slightly so as to be visible.)*

3. Select four other student volunteers to repeat lesson step 2. *(Make sure students stack the textbooks on top of each other. At the end of this process there should be five stacked textbooks with slips of paper taped to or inserted in them.)* Ask your students to determine which textbook was laid down first and which textbook was laid down last. Students should conclude that the textbook on the bottom of the stack was laid down first while the textbook on the top was laid down last. Tell your students that they just learned one of the most important rules of an archaeological excavation: The first layer of soil laid down is usually the last one to come out.

4. Give each student a copy of Worksheet 2. Tell your students that they will now be learning how archaeologists can date soil layers using the artifacts and features they unearth. Ask a student volunteer to read Rule 2 (from Worksheet 2) aloud to the class. Instruct the volunteer to unstack the textbooks and remove the attached slips of paper. Have the volunteer stack two books on top of each other. Provide another student volunteer with a coin, and tell the class to imagine that the coin has just been minted. Ask the volunteer to record the current time on the chalkboard. Choose another student to place the remaining three textbooks on the stack and place the coin within the pages of one of these books. Ask the class to relatively date the "layers" of books from the position of the coin. *(This exercise may be difficult for some students. Be sure to emphasize that the coin provides a reference time from which to determine when the remainder of the books were laid down.)* Conclude your coverage of Rule 2 by having students complete the questions for Diagram B on the worksheet.

5. Ask a student volunteer to read Rule 3 aloud to the class. Instruct the volunteer to remove the top two textbooks from the stack and place a notebook on top of the three remaining stacked books. Have the volunteer write the current time on a slip of paper and attach it to or insert it in the notebook as was done in lesson step 2. Ask the class to relatively date the layers of books below the notebook. Conclude the activity by having students complete the questions for Diagram C on the worksheet.

Answer key to questions for Diagram B on page 9

1. 1895 or later
2. D and E
3. A and B

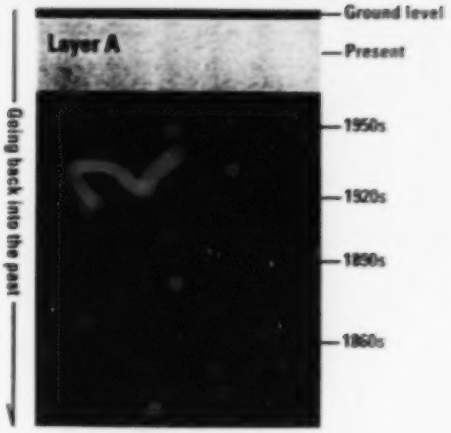
Answers to questions for Diagram C on page 9

1. Before the 1920s
2. A and B

WORKSHEET 2
Layers of the Past

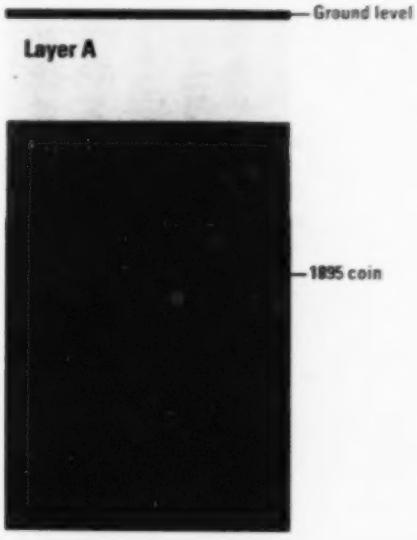
Rule 1
An archaeologist digs down into the past. The top layer of soil is the newest. The bottom layer is the oldest.

Diagram A



Rule 2
When a datable artifact (such as a coin) is found, the soil layer it was found in can be dated either after or at the same date as the artifact.

Diagram B



Questions for Diagram B

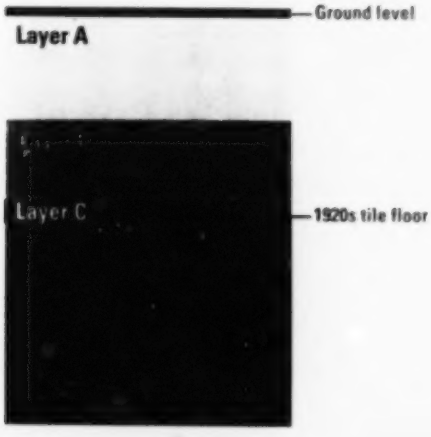
1. What appears to be the date of Layer C?

2. Which layers are probably older than Layer C?

3. Which layers are probably newer than Layer C?

Rule 3
When a solid, undisturbed layer (such as a tile floor) is found, all the soil layers below it date before that layer.

Diagram C



Questions for Diagram C

1. What appears to be the general date of Layers D and E?

2. Which layers are probably newer than Layer C?

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LESSON PLAN
Step 3

Archaeologists meticulously examine artifacts to learn more about the past. (Oahe Reservoir, South Dakota)

PUZZLE PIECES

Objectives

- Identify how archaeologists use typology to interpret artifacts.
- Interpret sample artifacts.

Materials

- Copies of the the Take-Home Page, page 11.
- Pens or pencils.

Subjects

Social studies, science, language arts

Procedure

1. Ask your students to imagine that they are expert archaeologists somewhere far in the future. Tell them that recent excavations have unearthed what appear to be several artifacts from the late twentieth or early twenty-first century. So far, no one has been able to identify the function and purpose of the artifacts. The field drawings and artifact descriptions have been turned over to the foremost experts (your students) for examination.

2. Give each student a copy of the Take-Home Page. Tell them that they will need to examine their collection of artifacts (at home, school, or a friend's house) to determine any similarities between their artifacts and those in the field drawings. *(Be sure your students understand that the artifact drawings depict only pieces of larger objects, much as archaeologists might find.)*

3. After your students have completed the Take-Home Page, ask them what they think each artifact is and what features of the field drawings or descriptions led them to their conclusions. *(Explain that archaeologists use the term* typology *to describe the matching of recently uncovered artifacts with previously identified artifacts.)* In some cases you may find that students may not have identified all of the artifacts correctly. Provide the correct answers with explanations as necessary.

4. Conclude the activity by telling your students that archaeologists often use typology to relatively date artifacts (especially pottery fragments). Stress that this is challenging work that requires years of specialized study. Note that archaeologists often only have fragments of artifacts to compare with other fragments, which may be thousands of years old.

ANSWER KEY:

Object 1
Television/VCR remote control

Object 2
Floppy disk

Object 3
Door key

Object 4
Fragment of a fork

Object 5
Base of a light bulb

Object 6
Portion of a cassette tape

Object 7
Modular telephone plug

Object 8
Prong to an electrical cord

CLAVES PARA LAS RESPUESTAS:

Objeto 1
Control Remoto de Television-VCR

Objeto 2
Disquete de Computadora

Objeto 3
Llave de una Puerta

Objeto 4
Pedazo de un Tenedor

Objeto 5
Base de un Bombillo

Objeto 6
Parte de un cassette

Objeto 7
Enchufe de un Teléfono

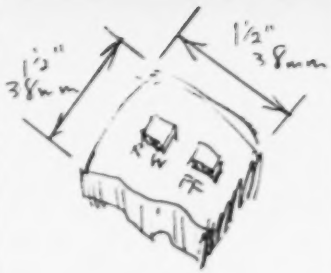
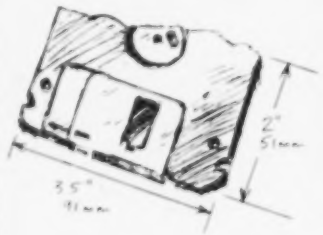
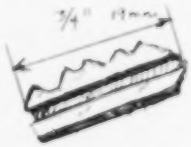
Objeto 8
Punta de un Cable Eléctrico

TAKE-HOME PAGE
Puzzle Pieces

To the teacher
- Duplicate this page for students.
- Use with Lesson Plan Step 3.

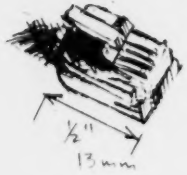
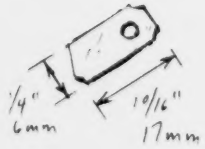
Publication of *Art to Zoo* is made possible through the generous support of the Pacific Mutual Foundation.

Directions: Imagine you are an archaeologist in the future. Because you are an expert on objects from the late twentieth and early twenty-first centuries, you have been asked to identify several artifacts found in a recent excavation. Compare the sketch of each object to examples you have in your own "collections" at home or at school.

Object	Description	What is it?
	**Object 1** Fragment of black plastic object with two rubber buttons. The writing below the buttons is difficult to read. The letters "FW" and "RW" are visible under two of the buttons.	
	**Object 2** Fragment of gray plastic and shiny metal. Square in shape with movable metal piece near bottom. Portion of a circular metal piece at the top of the object.	
	**Object 3** Fragment of highly polished, silvery metal. Several different notches along the top edge. Deep groove in side of object.	
	Object 4 Metal object with two long prongs. The prongs have sharp points.	

TAKE-HOME PAGE
Puzzle Pieces

Continued from page 11

Object	Description	What is it?
	Object 5 Intact rounded object with grooves and black ceramic case. Glass fragments attached to object. Glass fragments may have been part of a larger glass globe.	
	Object 6 Plastic spool with a long, thin, brown plastic strip wound around it. The spool has six notches and a groove to attach it to the end of the plastic strip.	
	**Object 7** Small, square, clear plastic object. Bendable plastic strip attached to object at one end. Gray cable with four colored wires (yellow, black, green, and red) attached to other end of object. Wires visible as they lead into the square, clear plastic.	
	**Object 8** Small, shiny, metal object with round hole in the side of one end. Two of these objects were located near each other.	

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TRABAJO PARA HACER EN FAMILIA
Piezas del Rompecabeza

Al Profesor

- Copie esta página para los alumnos.
- Usela con el tercer paso del plan de la lección.

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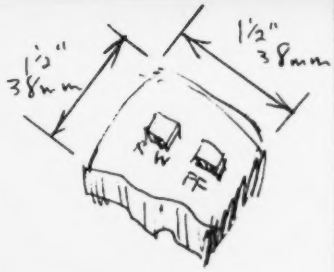
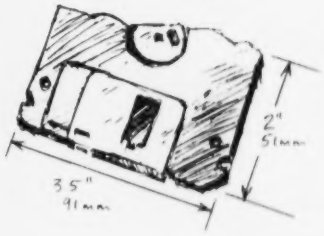
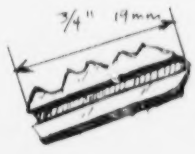
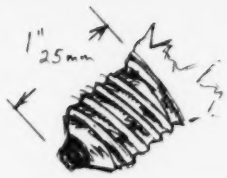
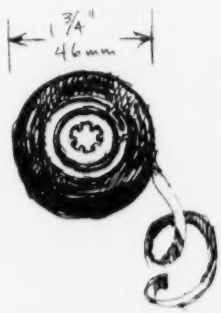
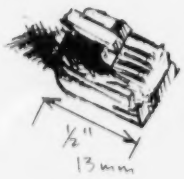
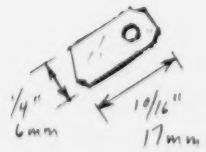
Instrucciones: Imagínese que Ud. es un arqueólogo en el futuro. Como Ud. es un experto en objetos de finales del siglo veinte y principios del ventiuno, se le ha pedido que identifique varios artefactos hallados en una reciente excavación. Compare los dibujos de cada objeto con las muestras que Ud. tiene en su propia "colección" en su casa y escuela.

Objeto	Descripción	Que es?
	**Objeto 1** Fragmento de un objeto negro en forma de caja con dos botones de plástico. Aunque es difícil leer lo que está escrito debajo de los botones, las letras "FW" y "RW" son legibles.	
	**Objeto 2** Fragmento de plástico gris. Tiene la forma de un cuadrado con una pieza movible en la parte de arriba. La pieza movible es de metal y tiene una ranura.	
	**Objeto 3** Fragmento de metal brillante. En la parte superior tiene varias protuberancias aserradas. Una ranura profunda se encuentra al costado del objeto.	
	Objeto 4 Objeto de metal con dos largas protuberancias. Las protuberancias son puntiagudas.	

TRABAJO PARA HACER EN FAMILIA
Piezas del Rompecabeza

Continua en la pagina 13

Objeto	Descripción	Que es?
	**Objeto 5** Objeto redondo con ranuras y una base de cerámica negra. Fragmentos de vidrio están adheridos a la base. Los pedazos de vidrio parecen haber sido parte de un globo de cristal aun mayor.	
	**Objeto 6** Carrete plástico con una cintilla larga y delgada de color café que lo envuelve. El carrete tiene seis lados y una ranura que sostiene la cintilla plástica en su sitio.	
	**Objeto 7** Pequeño objeto rectangular de plástico transparente. Una banda de plástico flexible sobresale por uno de los extremos. En el otro extremo hay un cable gris que contiene cuatro cables mas pequeños (de color amarillo, negro, verde, y rojo). Hay cables visibles a traves del rectángulo plástico transparente.	
	**Objeto 8** Pequeño objeto de metal brillante con un hueco en la parte de arriba. Dos de estos objetos fueron encontrados uno cerca del otro.	

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